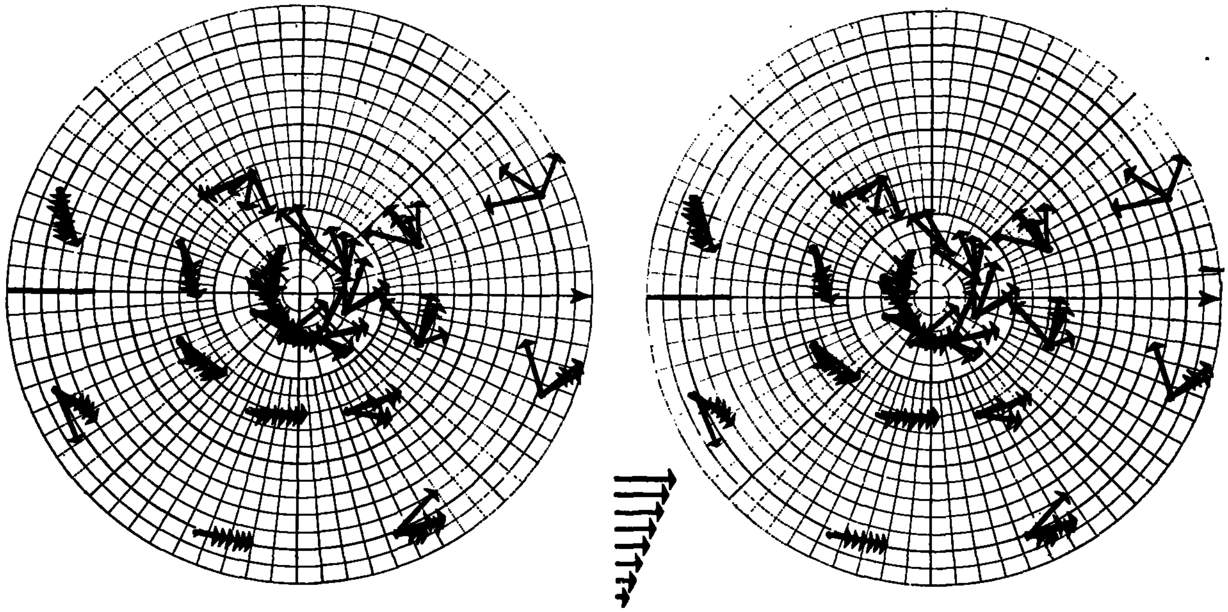

FIG. 2.—Average wind circulation aloft about LOWS, as determined by W. R. Blair, at Mount Weather, Va. (Longest arrow, surface at 526 m.; next, 1,000 m.; shortest, 7,000 m.)

The data from which the map is constructed are collected daily from the pilot balloon observation stations by telegraph. The posts are built up from the data and set in their relative positions, each post showing the wind conditions aloft for that particular station. From a distance of 10 feet away and perpendicular to the surface of the map a photographic exposure is made with a stereoscopic camera.

The object of using a stereoscopic camera is to set the flat map and superimposed arrows out in relief. For this work the stereoscopic camera has been replaced by one such as that the commercial photographer uses. Then, two separate exposures, one, 7½ inches to the right and the second 7½ inches to the left of the center of the map, are made. The principle is the same as that of the stereoscopic camera, but the results are far more satisfactory.

This system of upper air mapping with slight modification has been applied to "Means of wind observation in HIGHS and LOWS at Mount Weather. Blair—five-year summary, 1907 to 1912." Descriptions and explanations of the base figures have already been given in the Bulletin of Mount Weather Observatory, page 125, under "Wind direction at the different levels in relation to surface air pressure." Also in Report No. 13, Meteorology and Aeronautics, page 37, under "Wind change with height in LOWS."

Since wind velocities are not available for this summary, only the wind direction with altitudes could be represented; therefore, arrows with no designation of velocity were used.

Figure 1 represents average wind circulation aloft about HIGHS, and figure 2 represents average wind circulation aloft about LOWS, as determined from "Blair's Five-Year Summary of Mount Weather." If the accompanying figures are cut out and mounted, as printed, upon cards, they will be suitably arranged for study with the stereoscope. The arrows fly with the wind, and the length of the arrow decreases with increase in altitude.

THE ASCENSIONAL RATE OF PILOT BALLOONS.

By J. ROUCH.

[Translation and abstract from Comptes Rendus, Paris Acad., July 15, 1919, pp. 83-85

Aerological investigations carried on by the single theodolite method are dependent upon the assumption that the rate of ascent of a small rubber balloon filled with hydrogen is constant. During the war a great many experiments were made to verify and determine ascensional rates, a well as verify the fact that the rate of ascent is a function of the weight of the balloon and the ascensional force at the time the balloon is released.

Using rubber balloons, weighing 50 grams and given an ascensional force of 150 grams, 168 pilot-balloon flights were made by the two-theodolite method. The mean ascensional rate observed was 188 meters per minute.

The following table gives, for successive altitudes of 1,000 meters, the mean ascensional rate in meters per minute, together with the amounts of variation from the mean in each layer.

From—	To—	Number of observations.	Mean ascensional rate.	Amount of variation.			
				Less than one-tenth.	Between one-tenth and two-tenths.	Between two-tenths and three-tenths.	More than three-tenths.
Meters.	*Meters.*		*Min.*				
0	1,000	168	198	98	46	14	10
1,000	2,000	164	184	141	21	1	1
2,000	3,000	122	184	105	16	1	0
3,000	4,000	71	186	60	10	1	0
4,000	5,000	28	186	22	4	1	1
5,000	6,000	11	188	11	0	0	0
6,000	7,000	9	190	7	2	0	0
7,000	8,000	4	196	4	0	0	0
8,000	9,000	3	198	3	0	0	0
9,000	10,000	2	194	2	0	0	0

Notwithstanding the fact that above 6,000 meters the number of observations is very small, there were no variations greater than two-tenths of the rate. It appears, therefore, that it is possible to say that the ascensional rate of pilot balloons is practically constant up to 10 km.

In the first 1,000 meters, ascending currents of air very sensibly increase the upward rate of the balloon. These effects, which are due to convection, are noticeable throughout the day.

Various attempts have been made to formulate an expression for the ascensional rate in terms of the weight of the balloon and the ascensional force of the gas. Perhaps the best known is that of Dines, $V=84\frac{F^{\frac{1}{2}}}{(F+P)^{\frac{1}{3}}}$, where V is expressed in meters per minute, and F is initial ascensional force (free-lift) and P the weight of the balloon, both in grams. This formula was determined by a series of experiments with balloons weighing less than 20 grams.

The balloons generally used in France, however, weigh between 50 and 91 grams. With the aid of M. Parrot, a new formula was determined from more than 200 experiments with two and three theodolites, $V=42\frac{F}{(F+P)^{\frac{2}{3}}}$.

For balloons up to 100 grams this formula appears to give better results than that of Dines; for balloons of greater weight, however, a new series of experiments should be made.—*C. L. M.*

FURTHER MEASUREMENTS ON THE RATE OF ASCENT OF PILOT BALLOONS.[1]

By J. S. DINES.

Experiments were made in the Albert Hall, in which a clear height of 40 meters is available from floor level to the grid at the center of the domed roof. The formula in general use for the rate of ascent is, rising velocity, $V=q.\sqrt{L}/\sqrt[3]{(W+L)}$, where L = the free lift and W the dead weight of the balloon and q is a constant the value of which has to be determined under different conditions. It had been suggested that the value of q varied with different degrees of loading of the balloon. Attention was directed to this question and quantitative results obtained. Measurements were also made with a candle lantern of the pattern used for night ascents hung below the balloon. It was found that this produced no effect upon q. In timing the rate of ascent in closed buildings a fine thread has generally been attached to the neck and has been drawn up from the floor as the ascent proceeded. In the present case experiments which were made with and without such a thread showed that some correction is necessary where a thread is used. The general results confirmed the value $q=84$, which is used at the present time, for balloons of the size generally adopted for pilot balloon work. This value gives velocities in meters per minute when lift and dead-weight are expressed in grams.

In the discussion which followed Lieut. Col. Gold said that a considerable difference might exist between the rates of ascent in the open air and in a closed room. It would be of advantage if experiments could be conducted alongside the Eiffel Tower (300 meters high) with observers stationed on each platform. He carried out experiments with two theodolites in France, and the resulting rates of ascent varied from 100 to 300 meters per minute. Sir Napier Shaw thought the fact that several ascents were considered necessary for any conclusive result was very disturbing. It was desirable to devise a means of insuring the balloon rising in a straight line.—*Symons's Meteorological Mag., June, 1919, pp. 55–56.*

[1] Abstract of paper presented on May 21, 1919, before the Royal Meteorological Society, London.

MAN-CARRYING KITES FOR METEOROLOGICAL WORK.[1]

By L. P. FRANTZEN.

[Abstract from reviews in the Aeronautical Journal, London, November, 1918, p. 382, and May, 1919, p. 286.]

The author holds strongly that there is a great future for scientific kite flying for meteorological work, aerial photography, signaling, etc. As compared with the free balloon, the kite has the advantage that the instruments it carries give a continuous record of the conditions in a single locality and by the use of electrical connections the record can be made available at once. Kites of suitable construction will fly at heights from 2 to 3 kms. which can not be reached by kite balloons or "sausages."

[Man-carrying kites] must be stable in flight, and must act as a parachute if a sudden drop of wind occurs. They should fly in winds of from 5 to 25 m/s. In the scheme outlined for man-lifting a pilot kite is first sent up and the train of lifting kites attached to the cable at intervals of 10 to 30 meters. A basket traveling up the cable is used for the observer. The winch is preferably mounted on a lorry with separate motors for winding in the cable and driving the lorry. A dozen men have been found to be sufficient to manipulate a train of man-lifting kites. Sketches show several suggested forms of kites, both of the monoplane and box types. Details of construction are also shown.

THE STATIC CONDITION OF THE ATMOSPHERE.

By Dr. R. S. WOODWARD,

President, Carnegie Institution of Washington.

[Abstract of remarks made June 24, 1919, on the occasion of a joint meeting of the American Sections of Astronomy and Geophysics of the International Geophysical Union.]

Although the atmosphere is the special province of meteorologists it bears highly important relations to the sciences of astronomy and geodesy and sustains highly important relations also to the secular phenomena of geology. Visualizing the atmosphere in its entirety, it appears somewhat anomalous that the kinetic properties of that portion with which meteorology has been hitherto chiefly concerned have been more completely determined than the apparently simpler statical properties.

Of these latter, two are conspicuously outstanding, to wit, the mass distribution and the total mass of the atmosphere. Assuming that the atmosphere is a fluid and that it may have a boundary similar to the upper surface of the ocean, Laplace showed that the atmosphere is limited by a lenticular envelope symmetrical with respect to the polar axis of the earth and extending to a distance of about 17,000 miles at the poles, and to a distance of about 26,000 miles at the equator. But more recent investigations indicate with a considerable degree of probability that the atmosphere has no such limiting fluid surface. More recent investigations have indicated also that the total mass of the atmosphere is not constant but that it undergoes more or less continual exchanges

[1] L'Aérophile, Sept. 1–15, 1918, and especially "L'Avenir des Planeurs Captifs," L'Aérophile, Jan. 1–15, 1919, pp. 21–24.